Answers

CHAPTER 9 REVIEW PACKET

1. Use the following table about people who are in doctoral programs:

	Men	Women	
Completed	423	98	521
Still Enrolled	134	33	167
Dropped Out	238	98	336
	795	229	1024

a. How many rows? 3

b. How many columns? 2

c. How many variables? What are they?
2: gender and status in doctoral progra

d. How many cells? 6

2. For the table in problem 1, find the expected cell counts BY HAND (show work):

	M	W
Comp	(795)(521)/1024	(229)(521)/1024
Enr.	(795)(167)/1024	(229)(167)/1024
Drop.	(795)(336)/1024	(229)(336)/1024

=

	M	W
C	404.49	116.51
E	129.65	37.347
D	260.86	75.141

3. A large value of χ^2 tells us what about the expected and observed counts? What does a small value tell us?

large - expected is very diff from observed

small - expected and observed are similar

4. What other distribution is the χ^2 distribution related to?

binomial distribution - close to norm. approx. to bino

5. What parameter describes the χ^2 distribution?

df

6. Describe the shape of the χ^2 distribution.

- skewed right
- positive values only $(0 \to \infty)$

7. Is a χ^2 value of -12.3 possible? Why or why not?

χ^2 distr. always positive because statistic is the sum of squares

8. Why does the χ^2 test always use the upper tail of the χ^2 distribution?

any deviation from the null hypotheses makes the statistic larger.

9. How can we make the approximation of the χ^2 distribution more accurate?

distribution of χ^2 becomes more accurate as the cell counts increase.

10. How does the χ^2 statistic and distribution relate to the z statistic and the N(0,1) distribution? Why is the χ^2 statistic better than the z-statistic in general?

$\chi^2(1) = N(0,1)$

$\chi^2(1)$ critical values are equal to the square of the norm. distr. critical values

11. When analyzing a 2 x 2 table, what are the advantages of using a z statistic?

- we can test one or two sided, while χ^2 always tests two-sided.

Show work appropriate to the AP exam, as well as to Miss Senske's exams. All tests must have the following to be considered complete:

- **Assumptions (state and check)**
- **Hypotheses (written out)**
- **Test statistic (appropriate work shown)**
- **P-value**
- **Conclusion (in context of the problem, and asserting your decision)**

12. "Looking Up to Athletes" (*USA Today*, May 7, 1991) reported "Here's how sports team members say athletes do as role models for children: Excellent – 16%, Good – 38%, Fair – 41%, Poor – 5%." Suppose you took a poll of 350 members within your community and obtained the following results (in the same order): 44, 145, 133, 28. Do your results show that your community has a significantly different idea about athletes as role models than the sports team members?

χ^2-GOF

Ho: the obs. freq. distr. of athletes as role models fits the exp. distr.

Ha: " " " " " " " " " doesn't fit.

$$\chi^2 = \sum \frac{(obs - exp)^2}{exp} = \frac{(44-56)^2}{56} + \frac{(145-133)^2}{133} + \ldots = 10.7224$$

df = 3

$P(\chi^2 > 10.7224) = 0.0133$

– reject @ $\alpha = 0.05$

15. Alcohol and nicotine consumption during pregnancy may harm the fetus permanently. Because drinking and smoking behaviors may be related, it is important to understand the nature of this relationship when assessing the possible effects on children. One study classified 452 mothers according to their alcohol intake prior to pregnancy recognition and their nicotine intake during pregnancy. Carry out a complete analysis of the association between alcohol and nicotine consumption. χ^2 - Association

		Nicotine (mg/day)			
		None	15-Jan	16 or more	
Alcohol (oz/day)	None	105	7	11	123
	0.01-0.10	58	5	13	76
	0.11-0.99	84	37	42	163
	1.0 or more	57	16	17	90
		304	65	83	452

Ho: there is no assoc. btw. amt. of nicotine + amt. of alcohol

Ha: there is an assoc....

$$\chi^2 = \sum \frac{(obs-exp)^2}{exp} = \frac{(105-82.73)^2}{82.73} + \frac{(7-17.69)^2}{17.69} + \dots = 42.252$$

df = 6 $\quad P(\chi^2 > 42.252) = 1.6396 \times 10^{-7}$

- reject

16. A city expressway utilizing four lanes in each direction was studied to see whether drivers preferred to drive on the inside lanes. A total of 1000 automobiles were observed during the heavy early-morning traffic, and their respective lanes were recorded. Do the data present sufficient evidence to indicate that some lanes are preferred? State your hypotheses and carry out the test. χ^2 - GOF

Ho: the obs. distr of lanes fits the exp. distr.

Ha: " " " doesn't fit...

Lane	1	2	3	4
Observed Count	294	276	238	192

Exp = all 250 (uniform)

$$\chi^2 = \sum \frac{(obs-exp)^2}{exp} = \frac{(294-250)^2}{250} + \frac{(276-250)^2}{250} + \dots = 24.48$$

df = 3 $\quad P(\chi^2 > 24.48) = 1.98 \times 10^{-5}$

- reject

15. The Mendelian theory states that the number of peas of a certain type falling into the classifications round and yellow, wrinkled and yellow, round and green, and wrinkled and green should be in the ratio 9:3:3:1. Suppose that 100 such peas revealed 56, 19, 17, and 8 in the respective classes. Do these data disagree with the Mendelian theory?

16. A psychologist is investigating how a person reacts to a certain situation. He feels the reaction may be influenced by how ethnically pure the person's neighborhood is. He collects data on 500 people. Does there appear to be a relationship between neighborhood and reaction at the 0.10 level of significance?

χ^2-Assoc.

Pure?	Mild	Medium	Strong
Yes	170	100	30
No	70	100	30

H_0: there is no assoc. btw. reaction + neighborhood.

H_a: there is an assoc. btw. reaction + neighborhood.

$$\chi^2 = \sum \frac{(obs-exp)^2}{exp.} = \frac{(170-144)^2}{144} + \frac{(100-120)^2}{120} + \ldots = 22.569$$

$$P(\chi^2 > 22.569 \mid df = 2) = 1.3 \times 10^{-5}$$

- reject H_0 @ $\alpha = 0.10$